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 PATENT NO. 763,998

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HYDRAULIC BINDER FOR MORTAR OR CONCRETE

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The present invention relates to the production of a hydraulic binder for construction above and below the ground, a binder which, because of its initial high resistance to traction, is particularly suitable for putting up monolithic constructions from mortar or concrete that may be subjected to vibrations, such as that of road surfacing.

It is known that hydraulic mortars can be produced and improved by adding lime or cements, or by grinding with them latent additions from the hydraulic point of view such as trass, siliceous materials, glass powder, santorin earth, blast-furnace slag, fired clay etc. The production and improvement of hydraulic binders by the additions given above do not satisfy all the conditions.

In addition, it is known that the materials for latent addition from the hydraulic point of view always have a very high content of silicic acid (hydraulic factor) which makes them capable of transforming the rich lime into hydraulic lime or of also making hydraulic the lime hydrate which becomes free during the setting of cement and which decreases the resistance. The present invention is characterized in that it consists of the residual product from the production of alumina and aluminum, considered to be unusable such as red or white natrolite, being used to

produce a hydraulic binder of a specific type. Production of mortars and cements for constructions above and below the ground may be proposed for the use of this product. Although natrolite has a relatively low content of silicic acid (hydraulic factor) in contrast to the red slurry which is a residual product of the same industry, it has been noted that because of the high content of other materials (aluminum oxide and iron oxide), there is an extremely rapid reaction between the two components of lime and aqueous natrolite produced artificially, a reaction that is based on the fact that the lime contained in the aqueous alkaline alumina silicate produced artificially (natrolite) leads to an intimate combination in the same way as lime in the trass-based substance, with high content of silicic acid. In addition, the content of sodium hydroxide seems to favorably influence the binding and setting operation because the burnt clay containing iron, which also has a high content of aluminum and iron oxides (hydraulic factors), does not have a latent property from the hydraulic point of view. As a result of the intimate mixing with the natrolite-based product in conformance with the invention, rich lime may be given excellent hydraulic properties and hydraulic lime may be given an initial high resistance and a resistance to traction that is particularly very high, which was not possible up to now.

In addition to the initial high resistance of the binder according to the invention, it has a very particularly significant property which consists of a very favorable ratio of resistance to traction and to compression. In the case of the usual binders, this ratio is 1:10 up to 1:20, whereas with the new binder that may be obtained by adding natrolite by grinding, a ratio is obtained between the resistance to traction and the resistance to compression that reaches 1:4 to 1:5.

These ratios of resistance values show the expert that mortars and concretes obtained in this way have an extraordinarily low shrinkage tendency which for many applications of mortar, for example, road construction, has been sought for a long time.

Likewise, it is seen from this extraordinarily favorable ratio between traction and compression that these mortars are set in the form of a gel such that they remain insensitive to vibrations or other disturbances during the setting operation, while the mortars only from lime and cement and concrete set in a crystalline manner, and because of this, deteriorate under the action of vibrations which make them inelastic and brittle.

The composition of the natrolite gives the average value in the dry substance:

Melting loss, 10.0%;

SiO_2 , 27.0%

TiO_2 , 0.8%

Fe_2O_3 , 10.0%

Al_2O_3 , 29.5%

CaO , 3.5%

Na₂O, 17.0%

Na₂SO₄, 2.5%

The invention has considerable economic importance because by starting from the natrolite residue from the production of alumina, a cheap hydraulic binder can be produced which gives mortars and concretes an initial high resistance, which no longer makes them set in a more crystalline way but in the form of a gel, and which gives them an extraordinarily favorable ratio between the resistance to traction and the resistance to compression such that there is no longer a shrinkage tendency.

Example 1

Numerous tests made by the inventor in the Neuwied (Rhine) material test laboratories of the Research Institute for volcanic construction materials have given the following results:

Example 1a

The following resistances are reached with the cement lime from the "Burania" company without addition: mixing proportion 1:3 with Ferienwald normal sand.

After 3 days:

Compression.	66 kg/cm ²	Traction :
	66	Compression :
Traction....	7,0	= 1 : 9,3
	7,8	

After 7 days:

80 kg/cm ²	Traction :
82	Compression :
8,8	= 1 : 9,1
9,0	

Example 1b

Cement lime from the "Burania" company with the addition of natrolite. 84 parts by weight of cement lime + 15 parts by weight of natrolite + 1 part by weight of gypsum. Mixing proportion 1:3 with Ferienwald normal sand.

After 3 days:

Compression.	110 kg/cm ²	Traction :
	110	Compression :
Traction....	10,8	= 1 : 5,8
	10,3	

After 7 days:

194	kg/cm ²	Traction : Compression = 1 : 6,5
198	—	
19,5	—	
19,5	—	

Summary

Hydraulic binder characterized by the fact that natrolite, up to now considered to be waste and unusable, is mixed intimately with the bauxite residue from the production of alumina, with non-hydraulic or hydraulic binders such as lime or cement.

This binder may then be characterized by the following points, together or separately:

1. Natrolite is mixed intimately with a mixture of non-hydraulic (rich lime) and hydraulic binders;
2. Natrolite is mixed intimately with different hydraulic binders such as hydraulic lime and cement;
3. The hydration property is increased by the addition of a catalyst such as gypsum, for example.

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DIRECTION DE LA PROPRIÉTÉ INDUSTRIELLE.

BREVET D'INVENTION.

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Liant hydraulique pour mortier ou béton.

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La présente invention est relative à la fabrication d'un liant hydraulique pour constructions au-dessus et au-dessous du sol, liant qui, en raison de sa haute résistance initiale à la traction, convient particulièrement pour l'établissement de constructions monolithes en mortier et en béton, pouvant être soumises à des trépidations, telles en particulier que des revêtements de routes.

On sait que l'on peut fabriquer et améliorer les mortiers hydrauliques en ajoutant à des chaux ou des ciments, ou en broyant avec eux, des additions latentes au point de vue hydraulique telles que le trass, les matières siliceuses, la poudre de verre, la terre de santorine, le laitier de haut fourneau, l'argile cuite, etc. La fabrication et l'amélioration des liants hydrauliques par les additions indiquées ci-dessus ne satisfont pas à toutes les conditions.

On sait, en outre, que les matières d'additions latentes au point de vue hydraulique ont toujours une teneur très élevée en acide silicique (facteur hydraulique) qui les rend capables de transformer la chaux aérienne en chaux hydraulique ou de rendre également hydraulique l'hydrate de chaux qui devient libre lors de la prise du ciment et qui diminue la résistance. La caractéristique de la présente invention consiste en ce que le produit résiduel de la fabrication d'alumine

et d'aluminium considéré comme non utilisable, tel que la natrolite rouge ou blanche, est utilisé pour fabriquer un liant hydraulique d'un genre particulier. Comme utilisation de ce produit, on peut envisager la fabrication de mortiers et de bétons pour constructions au-dessus et au-dessous du sol. Quoique la natrolite ait une teneur relativement faible en acide silicique (facteur hydraulique) on a constaté, par opposition aux schlamms rouges qui sont un produit résiduel de la même industrie, que du fait de la teneur élevée en autres matières (oxyde d'aluminium et oxyde de fer) il se produit une réaction extrêmement vive entre les deux constituants : chaux et natrolite aqueuse, produite artificiellement, réaction qui repose sur le fait que la chaux contenue dans le silicate d'alumine alcalin aqueux produit artificiellement (natrolite) conduit à une combinaison intime de la même façon que la chaux dans la substance à base de trass, à forte teneur en acide silicique. En outre, la teneur en soude semble influencer favorablement l'opération de liaison et de prise car la poudre d'argile brûlée contenant du fer, qui a également une teneur élevée en oxydes d'aluminium et de fer (facteurs hydrauliques) ne possède pas de propriété latente au point de vue hydraulique. Grâce à un mélange intime avec le produit à base

Prix du fascicule : 5 francs.

RÉSUMÉ.

Liant hydraulique caractérisé par le fait que l'on mélange intimement de la natrolite, déchet considéré jusqu'ici comme 5 inutilisable, du résidu de bauxite de la fabrication de l'alumine, avec des liants non hydrauliques ou hydrauliques tels que des chaux ou des ciments.

On liant peut encore être caractérisé 10 par les points suivants, ensemble ou séparément :

1° La natrolite est mélangée intimement

avec un mélange de liants non hydrauliques (chaux aérienne) et hydrauliques ;

2° La natrolite est mélangée intimement 15 avec différents liants hydrauliques tels que de la chaux hydraulique et le ciment ;

3° La faculté d'hydratation est augmentée par addition d'un catalyseur tel que, par exemple, le gypse. 20

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